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Research Notes – Openness and Evolvability - Standards Assessment

Michael Haddy and Adam Sbrana (editor)*

Maritime Division
Defence Science and Technology Group

***Innovation Science**

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ABSTRACT

These Research Notes form part of a series of notes extracted from work undertaken by Innovation Science in the establishment of Openness and Evolvability assessment Methods and Processes. This set of Research Notes focusses on Standards Assessment. This work was undertaken from the late 1990s to 2007 and focussed on the application to Submarine Combat Systems.

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Produced by

*Maritime Division
DST Group Stirling
HMAS Stirling
PO Box 2188 Rockingham DC WA 6967*

Telephone: 1300 333 362

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Glossary

COI	Community Of Interest
HHI	Herfindahl-Hirschman Index
VOIP	Voice over Internet Protocol

1. Introduction

These Research Notes have been extracted from work undertaken by Innovation Science under contract to Defence Science and Technology Group during the period from the late 1990s until early 2007.

In entirety the Research Notes form a subset of the overall assessment Methodology and Processes developed to assess system level Openness and Evolvability.

The Research Notes within this report focus on Standards Assessment.

2. Standards Assessment

For the purposes of the openness assessment, the term “standard” is used broadly to refer to any public, industry (de facto), vendor, and custom specification that form the rules or model under which a component of the system is implemented or governed. Both formal and informal “standards” are equally relevant to the assessment and need to be evaluated.

Each standard or group of standards must be assessed for their risk to openness with respect to their use within the target architecture, infrastructure or interface. This standards assessment section is used as part of the architecture, infrastructure and interface assessment process. The standard assessment is not intended to assess the suitability of a standard for a particular application other than the standard’s effect on openness. For example, a standard may still pass the openness assessment, but not be at all suitable for use in a particular real-time deployment. The suitability of a standard to a particular engineering solution is beyond the scope of the openness assessment.

Note that if a standard (or group of standards) is encapsulated entirely within a granule (i.e. not part of an infrastructure or interface definition used by the granule) and is not visible to other granules within the architecture, then the standard does not require assessment.

The flowchart shown in Figure 1 summarises the assessment process. Each question within the flowchart is explained in greater detail in the sections that follow.

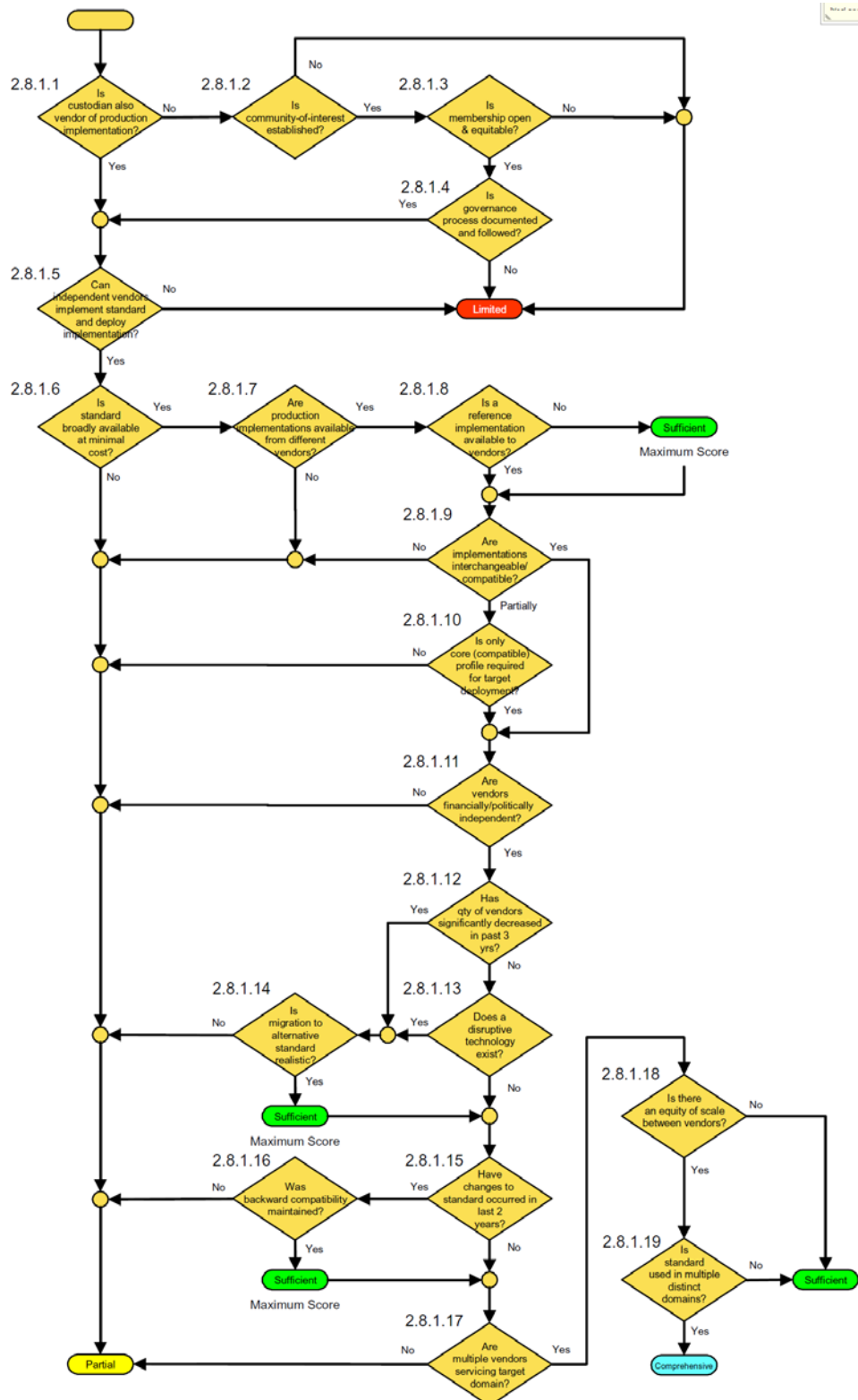


Figure 1. Assessing the Openness of a Standard

2.1 Standard Openness Questions

2.1.1 Is custodian also a vendor of production implementation?

The custodian of a standard could be a public standards organisation (such as IEEE, OMG, etc.), a government organisation, private consortium, private enterprise, or even an individual. It is conventional to assume a standard maintained by a public standards body is “more open” than one that is maintained by a proprietary alternative. However, if a standard is managed appropriately, there is no justification to disregard standards that originate from a proprietary organisation simply because of their origin.

A conflict of interest can arise that adversely affects openness when a standard managed by an organisation that is also a commercial vendor of an implementation of that standard. Safeguards are required to ensure adequate management of any such potential conflict of interest. This question is asking whether or not the organisation that is responsible for managing revisions to, and distribution of the standard, is also offering implementations of the standard for sale. Note this does not include the provision of reference implementations – only production implementations are of concern at this point.

2.1.2 Is community-of-interest established?

If the organisation managing the standard is also producing commercial implementations of the standard, it is imperative that processes are in place to ensure arbitrary changes are not applied to the standard at the discretion of the custodian. It is important that an appropriately constructed community-of-interest (COI) is responsible for planning of revisions to the standard. If a standard can be modified without regard for external vendors, the custodian of the standard has an unfair advantage. The company not only has the opportunity to be faster to market, but can also impose a level of control on its competitors. Implementations of the standard are therefore likely to diverge and competing standards (however similar) emerge. It is therefore critical that a community-of-interest governs the management of the standard.

2.1.3 Is membership open and equitable?

Any viable CPO must not place unnecessary restrictions on membership. A COI must give all interested parties equal right to shape the evolution and revision of the standard. There is nothing wrong with the COI charging for membership, provided the membership fees are equivalent for equivalent voting rights. Equally, members (or indeed the custodian itself) may sponsor the COI with an in-kind contribution in lieu of a financial contribution.

However, every effort must be made to ensure the custodian does not have unfair influence over the COI decision process.

2.1.4 Is governance process documented and followed?

A COI process needs to be documented in order to instil confidence that consistency is being achieved. Similarly, confirmation that the process is being followed should be sought. This could be achieved by contacting a random sample of COI participants to

obtain their view of the COI process, and indeed their opinion as to the success of the COI itself.

2.1.5 Can independent vendors implement standard and deploy implementation?

A standard must be able to be independently implemented and deployed by third-party vendors, otherwise the standard must be considered proprietary. If blanket or selective legal or access restrictions are imposed that prevent vendors deploying their own implementations of the standard, a risk exists that the custodian will use these restrictions to minimise competition. This may have a negative impact on acceptance and life span of the standard, and also introduces risks associated with a sole-source relationship (such as long-term cost and support).

The scope of access is important however. If the standard is intended only to be implemented and used within a well-defined community of interest, and access is limited to that community of interest, the access may be sufficient within the intended scope to consider the standard sufficiently accessible. An example could be a standard that defines the message format for classified data being passed between combat platforms. It would be unreasonable to force the standard to be published in the public domain if it compromised the security of the implementation. However, if the standard was freely available to vendors that had a need-to-know (regardless of their financial or political relationship with the standard's custodian), then access would be considered sufficient in this context.

2.1.6 Is standard broadly available at minimal cost?

Considering the intended scope for access of the standard, is the standard available without an unreasonable financial burden to any vendor that wishes to access the standard? If a cost is charged at all, the cost should be limited to the reimbursement of direct expenses incurred in delivering the standard to the recipient (such as shipping and handling charges). Note that if the scope of intended access is smaller than the public domain in general, the availability of the standard should not be restricted within the intended scope. Similarly, if a cost is charged, the cost should be consistent regardless of the organisation requesting access.

2.1.7 Are production implementations available from different vendors?

A standard that has only been implemented by a single vendor presents a number of risks to an end-user including:

- certainty of supply
- confidence that the implementation will continue to be supplied at reasonable cost.

2.1.8 Is a reference implementation available to vendors?

Broad availability of a reference implementation allows vendors to verify their own implementations for compliance against a common reference model. It also simplifies the

process of implementing the standard, so potentially encourages competing implementations to be developed, and for those implementations to be compatible with each other.

2.1.9 Are implementations interchangeable/compatible?

Compliance to the standard by all implementations is vital to the integrity of the standard itself. However, some standards (particularly those that are immature) allow vendors too much flexibility which causes the standard to either be extended with proprietary extensions, or implemented in incompatible ways.

There are three possible outcomes from this question. Either the majority of implementations are compatible, partially compatible or predominantly incompatible. If implementations are partially compatible, it is important to determine if a common compatible core “profile” of the standard is consistent amongst implementations.

2.1.10 Is only core (compatible) profile required for target deployment?

Assuming a common compatible core subset (profile) of the standard could be determined to be compatible amongst different implementations of the standard, determine if the profile is sufficient for the needs of the target deployment. If so, use of the compatible profile does not present a major risk, provided the incompatible extensions are not permitted.

2.1.11 Are vendors financially/politically independent?

The independence of different vendors’ implementations must be carefully assessed to ensure a monopolistic or oligopolistic condition does not exist. An attempt should be made to determine if any financial or political links exist between any pair of implementation vendors to determine the likelihood of a conflict-of-interest existing between those firms.

If the opportunity exists, the vendors could be asked to declare any financial or political affiliation they may have with other implementation vendors. However, this is unlikely to be practical in markets where the customer is not a significant participant.

2.1.12 Has the quantity of vendors significantly decreased in the past 3 years?

A decreasing number of vendors can mean either the market is maturing and less competitive vendors are leaving the market to leave only the strong, viable vendors. Or, it could mean that the standard is approaching obsolescence and vendors have chosen not to continue supporting the standard.

In order to determine the significance of a decrease in the number of vendors, a calculation using the Herfindahl-Hirschman Index [1] (HHI) can be used. The HHI provides an indication of market concentration and is calculated by summing the squares of the market share of each competing vendor. The reciprocal of the HHI provides an indication of the “equivalent” number of vendors based on the comparative size of the actual vendors.

$$V_{equiv} = \left(\sum_{i=1}^n s_i^2 \right)^{-1}$$

...where n is the number of vendors in the market, and s_i is the market share of firm.

For example, assume 12 companies each offered an implementation to an emerging market, and thus had relatively even market shares of between 6% and 11%. The equivalent number of vendors in the market might be calculated as:

$$V_{equiv} = (0.11^2 + 2(0.1^2) + 2(0.09^2) + 3(0.08^2) + 3(0.07^2) + 0.06^2)^{-1}$$

$$V_{equiv} = 11.66$$

As the market consolidated, it is likely that a market leader will appear, some smaller vendors will cease servicing the market, and the remaining vendors will absorb the remaining market share. For example:

$$V_{equiv} = (0.35^2 + 0.2^2 + 0.15^2 + 0.14^2 + 0.1^2 + 0.06^2)^{-1}$$

$$V_{equiv} = 4.58$$

As the market matures further, it is possible that one or two vendors will essentially monopolise the market. Even though a number of smaller vendors are available within the market, the equivalent number of vendors could be quite small. For example:

$$V_{equiv} = (0.5^2 + 0.45^2 + 0.02^2 + 0.01^2 + 0.01^2 + 0.01^2)^{-1}$$

$$V_{equiv} = 2.21$$

When the equivalent number of vendors decreases to less than two, questions should be asked as to the suitability of the standard.

2.1.13 Does a disruptive technology exist?

Disruptive technologies can rapidly make a previously popular standard, obsolete. For example, Voice over Internet Protocol (VoIP) is in the process of replacing traditional dedicated telephone exchanges and wiring. If a disruptive technology can be identified that risks replacing the standard being assessed, a migration plan is essential.

When deciding whether or not a disruptive technology is relevant to the standard being assessed, consider emerging variants of the current standard. For example, Gigabit

ethernet vs 10Mbps ethernet. Although in this particular case, a migration path was relatively straight-forward, there may be cases whereby backward compatibility is not maintained and therefore presents a serious risk to the long-term viability of the current standard.

2.1.14 Is migration to alternative standard realistic?

If a threat to the current standard has been identified, a migration path is needed that is realistic in terms of the goals of the target deployment. If migration from the current to emerging standard is likely to require all (or a substantial number of different) granule vendors to rework their implementation, the migration is unlikely to be a realistic option.

2.1.15 Have changes to standard occurred in last 2 years?

If the standard is continually evolving, it is essential that its evolution does not force users of the standard to repeatedly re-engineer their solutions in order to keep up with the latest standard version. There may be domains in which a 2 year assessment is inappropriate. However, in the vast majority of cases for computer-based standards, if the standard has remained unchanged for the past two years, it can be considered stable and most vendors implementing the standard are likely to have adopted the latest release.

2.1.16 Was backward compatibility maintained?

If the standard has changed in the past two years, it is necessary to determine whether or not backward compatibility was achieved. A standard that is sufficiently mature to allow incremental, backwardly compatible change, presents substantially less risk than one where users must re-engineer their solutions in order to keep pace with new revisions of the standard.

2.1.17 Are multiple vendors servicing target domain?

If the primary customer domain for the implementation does not align with the domain for the target deployment, evolution of the standard may be governed by the needs of the primary domain(s) and may conflict with the needs of the target application. In other words, even though the standard may appear appropriate for use in your target domain at the present time, pressures from the primary domain users may drive changes to the standard that cause it to diverge from your own goals.

Additionally, having only a single vendor supporting the target domain implies an effective sole-source relationship between the vendor and customer, and thus all of the risks associated with such a relationship.

2.1.18 Is there an equity of scale between vendors?

If one vendor implementing the standard is substantially larger or more powerful than all other independent vendors, there are several minor risks:

- smaller vendors could be forced out of the market through price competition

- smaller vendors could be forced out of the market due to the larger vendor driving evolution of the standard more quickly than can be supported by the smaller vendors
- the larger vendor could use their market position to introduce extensions to the standard that do not align with the goals of the community of interest – the standard may therefore diverge into official and de-facto versions
- smaller vendor(s) could be easily acquired by the larger vendor, thereby forming a monopoly. The HHI (see Section 2.1.12) could be used here, although the question is of equity rather than quantity, so it may be appropriate to divide the number of vendors by the HHI and determine equality based on how close the result is to 1.0.

2.1.19 Is standard used in multiple distinct domains?

A standard that has gained acceptance in multiple domains is more likely to resist domain specific pressures that adversely affect the suitability of the standard to the target domain that could otherwise be introduced as the standard evolves.

3. References

1. *The Herfindahl-Hirschman Index*, United States Department of Justice, <http://www.usdoj.gov/atr/public/testimony/hhi.htm>, Accessed 19 October 2007.

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